CLAIMS

1. A semiconductor light emitting device, comprising:

a semiconductor multilayer structure composed of a p-semiconductor layer, a quantum well emission layer, and an n-semiconductor layer each made of a nitride semiconductor and laminated in the stated order, light from the emission layer exiting through the n-semiconductor layer; and

a p-electrode facing and in ohmic contact with the p-semiconductor layer, wherein

the p-semiconductor layer has an intensive-injection region into which an electric current from the p-electrode is injected more intensively than another region, the intensive-injection region spanning substantially across an entire surface of the p-semiconductor layer.

2. The semiconductor light emitting device according to Claim 1, wherein

the intensive-injection region is realized by a contact structure of the p-electrode with the p-semiconductor layer.

3. The semiconductor light emitting device according to Claim 2, wherein

the p-electrode has, on a surface facing toward the p-semiconductor layer, a plurality of projections or depressions that are distributed substantially uniformly, and

the p-electrode is in contact with the p-semiconductor layer at a top surface thereof.

4. The semiconductor light emitting device according to Claim 3, wherein

the p-electrode is made of a metal that reflects light from the emission layer toward the n-semiconductor layer.

5. The semiconductor light emitting device according to Claim 4, further comprising

an insulator disposed on a recessed surface of the p-electrode to fill a space between the recessed surface and the p-semiconductor layer.

6. The semiconductor light emitting device according to Claim 5, wherein

the insulator is made of a material transparent to light emitted by the emission layer.

7. The semiconductor light emitting device according to Claim 5, wherein

the insulator has a substantially same refractive index as a refractive index of the nitride semiconductor forming the p-semiconductor layer.

8. The semiconductor light emitting device according to Claim 3, wherein

a drive current for driving the semiconductor light emitting device is maintained within such a range that results in an average current density not exceeding 50 A/cm^2, the average current

density being calculated by dividing the drive current by an area of a main surface of the emission layer,

the p-electrode faces substantially entirely of the main surface of the emission layer, and

a ratio between the top and recessed surfaces of the p-electrode is determined so that an electric current flowing through the top surface of the p-electrode measures at least 100 A/cm^2 in current density.

9. The semiconductor light emitting device according to Claim 3, wherein

the p-semiconductor layer has, on a surface facing toward the p-electrode, a high-defect region in which lattice defects are localized and a low-defect region formed adjacent to the high-defect region, and

the p-electrode is in contact with the low-defect region of the p-semiconductor layer.

10. The semiconductor light emitting device according to Claim 1, wherein

the intensive-injection region is realized by a contact structure of the p-semiconductor layer with the p-electrode.

11. The semiconductor light emitting device according to Claim 10, wherein

the semiconductor multilayer structure has, on a surface facing toward the p-electrode, a plurality of projections or depressions that are distributed substantially uniformly, and

the semiconductor multilayer structure is in contact with the p-electrode at a top surface of the p-semiconductor layer.

12. The semiconductor light emitting device according to Claim 11, wherein

the p-electrode is made of a metal that reflects light from the emission layer toward the n-semiconductor layer.

13. The semiconductor light emitting device according to Claim 11, wherein

a recessed surface of the semiconductor multilayer structure is present in the n-semiconductor layer.

14. The semiconductor light emitting device according to Claim 11, wherein

the semiconductor multilayer structure has, on the surface facing toward the p-electrode, a high-defect region in which lattice defects are localized and a low-defect region formed adjacent to the high-defect region, and

the low-defect region is present at the top surface of the semiconductor multilayer structure.

15. The semiconductor light emitting device according to Claim 1, further comprising:

a base substrate supporting the semiconductor multilayer structure from a direction of the p-semiconductor layer; and

a phosphor film disposed on a main surface of the semiconductor multilayer structure facing away from the base

substrate, the phosphor film extending across a side surface of the semiconductor multilayer structure to the base substrate.

16. A lighting module comprising:

a mounting substrate; and

the semiconductor light emitting device as defined in any one of Claims 1-15.

17. A lighting device comprising, as a light source, the lighting module as defined in Claim 16.

18. A surface mounting device comprising:

a substrate;

a semiconductor light emitting device as defined in any one of Claims 1-15, and mounted on the substrate; and

a resin molding the semiconductor device.

19. A dot-matrix display device comprising:

semiconductor light emitting devices as defined in any one of Claims 1-15 and are arranged in a matrix.